UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/607,910	06/27/2003	Joel William Hoehn	169.12-0591	8146

164 7590 02/03/2006

KINNEY & LANGE, P.A.
THE KINNEY & LANGE BUILDING
312 SOUTH THIRD STREET
MINNEAPOLIS, MN 55415-1002

EXAMINER	
MCDONALD, RODNEY GLENN	

ART UNIT	PAPER NUMBER
1753	

DATE MAILED: 02/03/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/607,910	HOEHN ET AL.	
	Examiner	Art Unit	
	Rodney G. McDonald	1753	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *November 15, 2006*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-19* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-19* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

Claims 1-19 are rejected under 35 U.S.C. 103(a) as being unpatentable over Segar et al. (U.S. 6,368,425) in view of Church et al. (U.S. PGPUB 2004/0180608) and Kawawake et al. (US PGPUB 2002/0036876).

Regarding claim 1, Segar et al. teach forming a tunneling magnetoresistive head comprising forming a stack including an upper pole 20 and a lower pole 22. The poles 20, 22 form a thin film core and can comprise a nickel-iron alloy. Conductive coils 26,

28 extend between the poles 20, 22 and are electrically insulated from the poles by an insulating layer 30. The elements make up the pole tip near the air bearing surface 32. (Column 4 lines 10-23) The pole tips 32 and the portion of the substrate 34 that underlies them can be lapped in a direction generally inward, toward the center of the thin film head to achieve the desired dimensions. The lapping process is a grinding process in which the exposed portions of the pole tips 32 are applied to an abrasive, such as diamond slurry. (Column 4 lines 31-42) Segar et al. further teach implanting ions just below the air bearing surface(s) 14 of the head (Fig. 4). The ions which can be implanted can be implanted onto the pole tips, over the entire surface of the transducers 18A, 18B or over the entire air bearing surfaces 14. (Column 5 lines 31-38) Reactive ions can be used. (Column 5 lines 39-40)

The differences between Segar et al. and the present claims is the ion etching of the surface to cause deficiencies in the constituents of the tunnel barrier in a portion of the tunnel barrier adjacent the surface and replenishing at least a portion of the constituent in the portion of the tunnel barrier adjacent the surface is not discussed (Claims 1, 9, 12), subplanting the constituent into the surface during ion etching is not discussed (Claim 2), replenishing the constituent after ion etching is not discussed (Claim 3), where the tunnel barrier material is made of an oxide insulating material is not discussed (Claim 4, 5, 11, 14), where the tunnel barrier material is made of a nitride material is not discussed (Claims 6, 15), where the tunnel barrier material is made of an oxynitride material is not discussed (Claims 7, 16), where the ion etching and the replenishing the constituent occur simultaneously (Claims 8, 17), ion etching the surface

in the presence of oxygen is not discussed (Claim 10), restoring the electrical property of the tunnel barrier is not discussed (Claims 13, 18) and the tunneling magnetoresistive head is not discussed (Claim 19).

Regarding the ion etching of the surface to cause deficiencies in the constituents of the tunnel barrier in a portion of the tunnel barrier adjacent the surface and replenishing at least a portion of the constituent in the portion of the tunnel barrier adjacent the surface (Claims 1, 9 and 12), Segar et al. already suggest implanting the entire air bearing surface of the TMR head. (See Segar et al. discussed above) Church et al. suggest that the implantation process causes mixing of ions into the air bearing surface and will cause sputtering of the surface to a lesser degree than the implantation. (Page 3 paragraph 0040; 0041) The sputtering here is believed to be the ion etching effect accomplished simultaneous with the ion implantation effect.

Regarding the subplanting of the constituent into the surface during ion etching (Claim 2), as is already discussed in Church et al. the ions are mixed into the layers during ion implanting thus being subplanted. (Church et al. Page 3 paragraph 0040; 0041)

Regarding replacing the constituent after ion etching (Claim 3), Kawawake et al. teach ion milling and then after implanting with oxygen. (Page 4 paragraph 0052, 0053)

Regarding where the tunnel barrier material is made of an oxide insulating material (Claim 4, 5, 11, 14), Kawawake et al. teach forming a TMR (tunnel magneto resistive head) having a layer stack 10 with a free magnetic layer 6, a non magnetic layer 7, a pinned magnetic layer 8 and an antiferromagnetic layer 7. (Page 3 paragraph

0038) The insulating layer is the tunnel barrier layer. (Page 2 paragraph 0030) Kawawake et al. teach forming the surface of a tunneling magnetoresistive stack by ion milling (i.e. ion etching). (Page 4 paragraph 0052) Ion implantation is performed with oxygen ions to the lateral portion of the element 10 such that it is oxidized. (Page 4 paragraph 0053) The insulating layer of the stack 10 can comprise a nonmagnetic layer including at least one selected from aluminum oxide. (Page 2 paragraph 0030)

Regarding where the tunnel barrier material is made of a nitride material (Claims 6, 15), Kawawake et al. teach the insulating layer of the stack 10 can comprise a nonmagnetic layer including at least one of aluminum nitride. (Page 2 paragraph 0030)

Regarding where the tunnel barrier material is made of an oxynitride material (Claims 7, 16), Kawawake et al. teach the insulating layer of the stack 10 can comprise a nonmagnetic layer including at least one of aluminum oxynitride. (Page 2 paragraph 0030)

Regarding where the ion etching and the replenishing the constituent occur simultaneously (Claims 8, 17), Church et al. suggest that the implantation process causes mixing of ions into the air bearing surface and will cause sputtering of the surface to a lesser degree than the implantation. (Page 3 paragraph 0040; 0041) The sputtering here is believed to be the ion etching effect accomplished simultaneous with the ion implantation effect.

Regarding where the ion etching the surface in the presence of oxygen (Claim 10), Church et al. suggest that reactive gases can be utilized including oxygen. (Page 3 paragraph 0038)

Regarding restoring the electrical property of the tunnel barrier (Claims 13, 18), since the tunnel barrier layer is implanted with ions (i.e. oxygen) as shown by Church et al. discussed above the electrical property of the tunnel barrier is believed to be effected. (See Church et al. discussed above)

Regarding the tunneling magnetoresistive head (Claim 19), Segar et al. discussed above teach the tunnel magnetoresistive head. (See Segar et al. discussed above)

The motivation for the ion etching of the surface to cause deficiencies in the constituents of the tunnel barrier in a portion of the tunnel barrier adjacent the surface and replenishing at least a portion of the constituent in the portion of the tunnel barrier adjacent the surface, subplanting the constituent into the surface during ion etching, where the ion etching and the replenishing the constituent occur simultaneously, ion etching the surface in the presence of oxygen and restoring the electrical property of the tunnel barrier because it allows for reducing the noise problems caused by GMR effects. (See Church et al. Page 1 lines 0010)

The motivation for replenishing after ion etching, utilizing a tunnel barrier material is made of an oxide insulating material, made of a nitride material, made of an oxynitride material is that it allows for production of a magnetic head with high resistance changes. (See Kawawake et al. Page 1 paragraph 0004)

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have modified Segar et al. by ion etching of the surface to cause deficiencies in the constituents of the tunnel barrier in a portion of the tunnel barrier

adjacent the surface and replenishing at least a portion of the constituent in the portion of the tunnel barrier adjacent the surface, subplanting the constituent into the surface during ion etching, where the ion etching and the replenishing the constituent occur simultaneously, ion etching the surface in the presence of oxygen and restoring the electrical property of the tunnel barrier as taught by Church et al. and to have ion implanted after ion etching, utilized a tunnel barrier material made of an oxide insulating material, made of a nitride material, made of an oxynitride material as taught by Kawawake et al. because it allows for production of a magnetic head with high resistance changes and because it allows for reducing the noise problems caused by GMR effects.

Response to Arguments

Applicant's arguments filed November 15, 2006 have been fully considered but they are not persuasive.

In response to the argument that product-by-process claims are definite, it is agreed that product-by process claim 19 is definite and the 35 U.S.C. 112 rejection is withdrawn. The 35 U.S. C. 103 rejection over claim 19 stands based on the rejection above.

In response to the argument that there is no teaching in the prior art of ion etching the air bearing surface to cause deficiencies of a constituent of the tunnel barrier, it is argued that the ion implantation of Segar would cause an ion etching and replenishment of a component of the layer. This reasoning is based on Church which shows that during ion implantation there is a "sputter etching" taking place during ion

implantation which is the required ion etching step of the claims and the implantation step is the "replenishing" step of the claims. Oxygen can be the ion to implant and is part of the tunnel barrier. (See Segar and Church discussed above)

In response to the argument that there is also no teaching in the prior art of replenishing at least a portion of the constituent in the portion of the tunnel barrier adjacent the air bearing surface, it is argued as discussed above that Segar and Church suggest that part of the tunnel barrier would be "replenished" as a result of the implantation utilized. (See Segar and Church discussed above)

Conclusion

THIS ACTION IS MADE FINAL. Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Rodney G. McDonald whose telephone number is 571-272-1340. The examiner can normally be reached on M- Th with Every other Friday off.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nam X. Nguyen can be reached on 571-272-1342. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Rodney G. McDonald
Primary Examiner
Art Unit 1753

RM
January 30, 2006